CLAIMS

1. A method of manipulating a biological or a chemical species comprising:

manipulating a biological or a chemical species in a confined space having a maximum dimension of less than 5 cm using a magnetic field.

2. The method of claim 1, wherein the species is attached to a particle comprising a magnetic material.

3. The method of claim 2, wherein the particle includes a coating and a magnetic material core.

4. The method of claim 3, wherein the particle has a size of less than 100 microns.

5. The method of claim 1, wherein the magnetic field is generated by one or more current earrying wires.

6. The method of claim 5, wherein the wires are disposed on a substrate.

7. The method of claim 1, wherein the magnetic field is generated by a magnetizable layer.

8. The method of claim 7, wherein the magnetic field generated by the magnetizable layer is induced in the magnetizable material.

9. The method of claim 1, wherein the confined space is defined on a substrate.

10. The method of claim 9, wherein the confined space comprises a channel defined by local field maxima generated by current flowing through wires formed on the substrate.

11. The method of claim 1, wherein the confined space has a maximum dimension of less than 1 mm.

12. The method of claim 1, wherein the species is suspended in a fluid.

13. The method of claim 1, comprising manipulating the species without fluid flow.

14. The method of claim 1, wherein manipulating the species comprises directing the motion of the species.

15. The method of claim 1, further comprising moving the biological or chemical species by attracting the species with a magnetic field.

16. The method of claim 1, comprising varying the position of the magnetic field by ehanging the position of local field maxima.

17. The method of claim 1, wherein manipulating the biological or chemical species comprises capturing and confining the biological or chemical species.

18. The method of claim 1, comprising manipulating a first biological or chemical species in a confined space having a maximum dimension of less than 5 cm using a magnetic field to bring the first species in contact with a second biological or chemical species thereby causing a reaction between the first and second species.

19. The method of claim 1, comprising separating a first biological or chemical species from a second biological or chemical species in a confined space having a maximum dimension of less than 5 cm using a magnetic field.

20. A method of manipulating a biological or chemical species comprising:

manipulating a biological or a chemical species on a substrate in the absence of structural boundaries capable of confining the species.

21. The method of claim 20, comprising selectively manipulating the species using a magnetic field.

22. The method of claim 21, wherein the magnetic field is generated by one or more current carrying wire disposed on a substrate.

23. The method of claim 20, wherein the species is attached to a particle comprising a magnetic material.

24. The method of claim 20, wherein the particle has a size of less than 100 microns.

25. The method of claim 21, wherein the magnetic field defines, at least in part, a channel in which the species may move.

26. The method of claim 25, wherein the channel has a maximum dimension of 5 cm.

27. The method of claim 20, wherein the species is suspended in a fluid.

28. The method of claim 20, comprising manipulating the species without fluid flow.

29. The method of claim 20, wherein manipulating the species comprises directing the motion of the species.

30. The method of claim 20, further comprising moving the biological or chemical species.

31. The method of claim 30, comprising moving the biological or chemical species by varying the position of the magnetic field.

32. A method of manipulating a biological or chemical species comprising:

manipulating a biological or a chemical species using a magnetic field generated by one or more current carrying wires.

33. The method of claim 32, wherein the wires are disposed on a substrate.

34. The method of claim 32, wherein the magnetic field defines, at least in part, a channel in which the species may move.

35. The method of claim 34, wherein the channel has a maximum dimension of 5 cm.

36. The method of claim 34, wherein the channel has a maximum dimension of 1 mm.

37. The method of claim 32, wherein the species is attached to a particle comprising a magnetic material.

38. The method of claim 32, wherein manipulating the species comprises directing the motion of the species.

39. The method of claim 32, further comprising moving the biological or chemical species.

40. The method of claim 32, comprising moving the biological or chemical species by varying the position of the magnetic field.

41. A method of manipulating a biological or chemical species comprising:

moving a biological or chemical species in a first direction; and

changing the direction of motion of the biological or chemical species using a magnetic field.

42. The method of claim 41, wherein the magnetic field defines, at least in part, a boundary.

43. The method of claim 41, comprising moving the species in the first direction a distance of less than 5 cm prior to changing the direction of motion.

44. A method of manipulating a biological or chemical species comprising:

manipulating a biological or a chemical species on a substrate in the absence of fluid flow.

45. A microfluidics system comprising:

a substrate including a plurality of wires capable of carrying current to generate magnetic fields that define channels on the substrate; and

a biological or chemical species movable within the channels on the substrate.

46. The microfluidics system of claim 45, wherein the species is attached to a particle comprising magnetic material.

47. The microfluidics system of claim 46, wherein the particle includes a coating and a magnetic material core.

48. The microfluidics system of claim 45, wherein the particle has a size of less than 100 microns.

49. The microfluidics system of claim 45, wherein the substrate has a maximum dimension of less than 5 cm.

50. The microfluidics system of claim 45, wherein the substrate has a maximum dimension of less than 1 mm.

51. The microfluidics system of claim 45, further comprising a fluid disposed on the substrate, the species being flowable through the fluid.

52. The microfluidics system of claim 45, further comprising a voltage source connectable to the plurality of wires.

53. The microfluidics system of claim 45, further comprising an external magnet.

54. The microfluidics system of claim 45, further comprising a magnetizable material layer disposed on the substrate.

55. A microfluidics system comprising:

a channel; and

a feature formed within the channel, the feature capable of generating a magnetic field.

56. The microfluidics system of claim 55, wherein the channel is defined within a substrate.

57. The microfluidics system of claim 56, wherein the substrate comprises a polymer.

58. The microfluidics system of claim 56, wherein the substrate has a largest dimension of less than about 5 centimeters.

59. The microfluidics system of claim 55, wherein the channel is defined within a tube.

60. The microfluidics system of claim 55, wherein the feature comprises a magnetic material.

61. The microfluidics system of claim 60, wherein the magnetic material comprises nickel.

62. The microfluidics system of claim 55, wherein the feature is completely contained within the channel.

63. The microfluidics system of claim 55, wherein the microfluidics system comprises an array of features.

64. The microfluidics system of claim 63, wherein the array has features of at least two different sizes.

65. The microfluidics system of claim 55, wherein the feature comprises a post.

66. The microfluidics system of claim 55, wherein the channel has a width of less than about 1000 micrometers.

67. The microfluidics system of claim 66, wherein the channel has a width of less than about 10 micrometers.

68. The microfluidics system of claim 55, further comprising a fluid within at least a portion of the channel.

69. The microfluidics system of claim 68, further comprising chemical or biological species carried by the fluid.

70. The microfluidics system of claim 69, wherein the magnetic field manipulates the ehemical or biological species.

71. The microfluidics system of claim 69, wherein the chemical or biological species are attached to particles.

72. The microfluidics system of claim 71, wherein the magnetic field manipulates the particles.

73. The microfluidics system of claim 69, comprising different types of chemical or biological species.

74. The microfluidics system of claim 73, wherein different types of species are respectively attached to different types of particles.

75. The microfluidics system of claim 73, wherein the system is designed to separate different types of species.

76. A microfluidics system including a channel defined therein, wherein the system is eapable of producing a magnetic field confined within the channel.

77. The microfluidics system of claim 76, wherein the magnetic field is an induced magnetic field.

78. The microfluidics system of claim 76, wherein the magnetic field is produced by an electromagnet.

79. A microfluidics system comprising:

a substrate having a channel defined therein; and

a feature formed within the channel, the feature comprising a magnetic material.

80. A method comprising manipulating a chemical or biological species within a channel in a microfluidics system using a magnetic field generated by a feature formed within the channel.

81. The method of claim 80, wherein the chemical or biological species are attached to particles and the particles are manipulated by the magnetic field.

82. The method of claim 81, further comprising manipulating at least two different types of chemical or biological species.

83. The method of claim 82, wherein manipulating the at least two different types of chemical or biological species comprises separating a portion of a first type of chemical or biological species from a portion of a second type of chemical or biological species.

84. The method of claim 80, wherein manipulating the chemical or biological species comprises capturing at least a portion of the chemical or biological species.

85. The method of claim 80, wherein the magnetic field generated by the feature is induced by an external magnet.

86. The method of claim 80, wherein the chemical or biological species are carried within a fluid.

87. The method of claim 80, further comprising manipulating a second species within a second channel in the microfluidics system using a second magnetic field generated by a second feature formed within the second channel.

88. A method comprising generating a magnetic field confined within a microfluidic channel.

89. The method of claim 88, further comprising inducing the magnetic field using a magnetic field external of the microfluidic channel.

90. The method of claim 88, wherein the magnetic field confined within the microfluidic channel is generated without simultaneously generating a second magnetic field confined within a second microfluidic channel.

91. The method of claim 88, wherein the magnetic field is generated by a feature formed within the microfluidic channel.

92. A method comprising manipulating a species in a microfluidics system using an applied magnetic field of less than about 500 gauss within a channel.

93. The method of claim 92, wherein using an applied magnetic field comprises using an applied magnetic field of less than about 100 gauss within the channel.

94. A method of forming a microfluidics system comprising:
forming a channel defined by the microfluidics system; and
forming a feature within the channel, the feature capable of generating a magnetic field.

95. The method of forming a microfluidics system of claim 94, wherein forming a channel comprises forming a channel using soft lithography.

96. A microfluidics system comprising:
a channel;
a feature having a smallest dimension no greater than the smallest dimension of the channel proximate the feature, positioned so as to be capable of generating a magnetic field within the channel.

97. The microfluidics system of claim 96, wherein the channel is defined within a substrate.

98. The microfluidics system of claim 96, wherein the feature comprises a magnetic material.

99. The microfluidics system of claim 96, wherein the microfluidics system comprises an array of features.

100. The microfluidics system of claim 96, wherein the magnetic field manipulates a chemical or biological species.

101. The microfluidics system of claim 100, wherein the chemical or biological species are attached to particles.

102. The microfluidics system of claim 96, wherein the magnetic field is an induced magnetic field.

103. A method comprising:

applying a magnetic field able to manipulate a chemical or biological species within a first channel in a microfluidics system, the magnetic field unable to manipulate a similar species within a second channel in the microfluidics system.

104. The method of claim 103, wherein the second channel is separated from the first channel by no more than 5 centimeters.

105. The method of claim 104, wherein the second channel is separated from the first channel by no more than 1000 micrometers.

106. The method of claim 103, wherein the chemical or biological species are attached to particles and the particles are manipulated by the magnetic field.